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REVIEW

Validity and reliability of instruments designed to measure factors influencing the overuse of antibiotics

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Abstract
Background: Antibiotic overuse is a global public health issue that is influenced by several factors. The degree and prevalence of antibiotic overuse is difficult to measure directly. A more practical approach, such as the use of a psycho-social measurement instrument, might allow for the observation and assessment of patterns of antibiotic use.
Study objective: The aim of this paper is to review the nature, validity, and reliability of measurement scales designed to measure factors associated with antibiotic misuse/overuse.
Design: This study is descriptive and includes a systematic integration of the measurement scales used in the literature to measure factors associated with antibiotic misuse/overuse. The review included 70 international scientific publications from 1992 to 2010.
Main results: Studies have presented scales to measure antibiotic misuse. However, the workup of these instruments is often not mentioned, or the scales are used with only early-phase validation, such as content or face validity. Other studies have discussed the reliability of these scales. However, the full validation process has not been discussed in any of the reviewed measurement scales.
Conclusion: A reliable, fully validated measurement scale must be developed to assess the factors associated with the overuse of antibiotics. Identifying these factors will help to minimize the misuse of antibiotics.

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Contents

Introduction

Antibiotic misuse and overuse is a major public health issue worldwide. Antibiotic misuse/overuse is influenced by several contributing factors related to patients and/or their parents or to doctors. Factors leading to antibiotic overuse are likely to include demographic characteristics (e.g., socio-economic status, age, and education level) or psycho-social aspects, such as behaviors and attitudes (e.g., self-medication, over-the-counter medication, and patients' expectations). Other factors, such as lack of health education, may also contribute to the misuse/overuse of antibiotics. A valid and reliable measurement scale is needed to measure these factors. The development of measurement instruments is a central aspect of psycho-social research because these instruments offer a way to assess constructs that are not otherwise observable, such as the phenomenon of antibiotic misuse.

Scale development includes several steps to establish validity and reliability. The content validity of an instrument can be assessed using qualitative methods, such as the Delphi technique or focus groups. Face validity can be assessed in a pilot study. The number and nature of the underlying constructs and the item selection process can also be established in a pilot study using exploratory factor analysis (EFA). In addition, construct validity can be assessed using confirmatory factor analysis (CFA). Ideally, criterion-related validity should be established by gauging the strength of the new instrument against an existing valid instrument (or a gold standard). However, this method assumes that an established instrument exists for this purpose. This article will review various worldwide measurement scales designed to measure factors associated with antibiotic misuse. The validity and reliability of these scales will be reviewed.

Methods

The data sources included in this review article are studies that attempted to establish factors associated with antibiotic misuse/overuse. Typically, the reviewed studies in this article were cross-sectional, and the scales used in these studies were directed at patients/parents, doctors, or both of these populations. The inclusion criteria required that only articles that measured patterns of antibiotic use were included in this study.

Full workup of an instrument

Rating scales are one of the most important instruments used in the psycho-social healthcare field because they facilitate the measurement of constructs that are otherwise unobservable or difficult to measure. Assessing the validity and reliability of such instruments is integral to assessing an instrument's usefulness. Reliability can be assessed by confirming an instrument's ability to measure a consistent attribute [1]. The validity of an instrument is assessed by confirming the instrument's capability to measure what it is intended to measure. Four types of validity are often discussed: content validity, face validity, construct validity, and criterion validity [2]. The content validity of an instrument can be assessed using qualitative methods, such as the Delphi technique or focus groups. Construct validity is usually assessed using confirmatory factor analysis. In the following sections, each stage of the

validation process is discussed and ordered based on the location of each stage in the workup process.

Early-stage validation (content and face validity)

The validation of an instrument's content consists of determining whether all relevant content is covered by the instrument. Lawshe [3] and Lynn [4] created two methods to measure content validity: the content validity ratio and the content validity index. Content validity can be measured by reviews of the literature, expert opinions, population sampling, and qualitative research [1]. Expert opinions are the most common method of assessing content validity, and a common approach used to collect expert opinions is the Delphi technique.

In the Delphi technique, experts scale an item's relevance to the topic. This technique was originally developed by Dalkey and Helmer in 1963 [5] and is defined as a group communication method aimed at achieving consensus among a group of experts about a particular issue. The consensus is established using a series of questionnaires that are iteratively delivered to participants to collect relevant data [5,6]. Some authors suggest that the number of iterations used in a Delphi should vary from 3 to 5 [7]. The Delphi technique provides anonymity to the respondents, a controlled feedback process, and a variety of statistical analysis techniques to interpret the data [8]. Additionally, the use of electronic technologies (e.g., email or teleconferencing) to administer Delphi questionnaires and feedback can be considered an advantage that improves practicality [7]. Yousuf [8] noted that these advantages are designed to offset the limitations of the usual methods of collecting opinions in group interactions (i.e., the effects of dominant individuals, noise, and group pressure). Nevertheless, the Delphi technique has a few limitations, such as the possibility of a low response rate and of unintentionally guiding feedback from the respondent group. Furthermore, the nature of the Delphi technique makes the process time consuming.

Face validity focuses on subjective assessments [1], such as evaluations of grammar, syntax, organization and appropriateness as well as confirmation that the survey instrument seems to flow logically.

Middle-stage validation (construct validity)

Construct validity is the extent to which an instrument measures the construct it is intended to measure. According to Ramaker et al. [2], factor analysis is often used to measure the intercorrelation of an instrument's components, which contributes to condensing the number of dimensions (or domains) in the instrument by grouping related items under the same dimension. Construct validity is achieved when (1) a tool is capable of measuring the differences between contrasting groups of participants, (2) the scores reflect the framework hypothesized in an inferential testing study, or (3) confirmatory factor analysis validates the extent to which the statistical model fits the data [1].

There are two main types of factor analysis (FA): EFA which is generally used to investigate the possible number and nature of underlying constructs, and CFA which is used to confirm the structure (usually identified by a prior EFA) and determine whether the factor structures can be measured by survey items [9].

Final-stage validation (criterion validity)

DeVon [1] described criterion validity as the extent to which an instrument compares with external variables (or a gold standard) that are considered direct measures of the characteristic or behavior being examined. Intelligence test scores used to predict future performance are an example of criterion validity.

Because no existing validated instrument measures the public's perceptions and behaviors regarding antibiotics, any instrument developed for this purpose cannot currently be criterion validated. This article provides evidence of the lack of a fully validated instrument that can be used to measure the factors that influence parents' overuse of antibiotics in children with upper respiratory tract infections.

Existing scales

Scales designed to measure the association between patients/parents and antibiotic misuse in the community

Several studies have been directed at patients or guardians to measure the factors influencing the overuse of antibiotics (Table 1). Most of these studies attempted to measure attitudes, beliefs, knowledge, and experience with antibiotics [10—16] as well as behaviors such as over-the-counter medication [17] or self-medication [12,16,18—23]. Some studies have assessed patients' views regarding patient—doctor interactions and patient satisfaction [14,24—26]. Factors included in the

Table 1 Scales directed at patients/parents.

Patients-related					
Study	Country	Target population	Development and validation of instrument	Implementation	Dimensions measured in the scale
[23]	Jordan	Patients and parents	Self-developed, and preliminary validation took place (content validity)	Self-administered	Self-medication
[16]	Sudan	Patients	Development not mentioned, Pilot tested	Self-administered	Socio-economic status, Knowledge, self-medication
[18]	KSA	Patients and parents	Self-developed, and pilot tested (content validity)	Self-administered	Behavior (self-medication) and attitude in AB use
[11]	USA	Patients and parents	The development and validation are not mentioned	Telephone survey	Attitudes, beliefs, knowledge, expectations and experiences
[19]	China	Parents	Development is not mentions, Devised by a group of investigators and Pilot tested (content validity and face validity assessed)	The school authority asked the guardians to completed the questionnaires anonymously	Behaviors (self-medication),
[30]	USA	Patients and parents	Self-developed, validation is not mentioned	Telephone surveys	Expectations
[12]	Maltese	Patients and parents	Self-developed and pilot tested	Completed by trained interviewers	Knowledge and attitude
[33]	China	Patients and parents	Self-developed, pilot tested for face validity, content validity ensured using experts opinions	Self-administered	Knowledge, attitudes, behavior, and expectations
[10]	Malaysia	Parents	Self-developed and pilot tested (content validity assessed)	Interviewer-administered	Experience with antibiotics
[36]	USA	Patients	Derived from other studies [13,38]	Telephone survey	Knowledge, attitudes and awareness
[26]	UK	Patients and parents	Development and validation are not mentioned Generalizability coefficient was used to assess reliability	Self-administered	Patient—doctor interaction and The reliability of assessment
[39]	New Zealand	Patients	Self-developed, validation not mentioned	Telephone interviews	Management of behavior, knowledge, attitudes, and behavior
[68]	USA	Patients	Self-developed and pilot tested	Patients: in-depth-telephone interviews using audio-vignette	Patients views, beliefs and preferences To measure medication adherence (not related to antibiotics)
[13]	USA	Patients	Self-developed and pilot tested	Telephone interviews	Knowledge, attitude, experience
[20]	Europe	Patients	The development and validation are not mentioned	Mailed randomly	Experiences and behaviors (self-medication)

Table 1 (*Continued*)

Patients-related					
Study	Country	Target population	Development and validation of instrument	Implementation	Dimensions measured in the scale
[17]	USA	Mothers	The development and validation are not mentioned	Telephone or Interview	Behavior: over-the-counter medication
[28]	USA	Parents	Self-developed and pilot tested	Mailed questionnaires to families	Parental knowledge and attitudes about AB
[34]	USA	Patients and parents	Development is not mentioned, content validity assessed using focus groups	Focus groups and self-administered questionnaires	Knowledge attitudes, and practice regarding Antibiotic use
[14]	Greece	Patients and parents	Self-developed and pilot tested	Interview	Attitudes, beliefs, adherence, satisfaction
[37]	9 European countries	Patients and parents	The development and validation are not mentioned	Telephone survey	Antibiotic knowledge and views
[15]	Trinidad and Tobago	Patients and parents	Development is not mentioned, pilot tested	Telephone interviews	Knowledge, beliefs and practices
	General	Systematic review	NA	NA	Factors that influence the use of antibiotics by prescribers, dispensers and community members in low-income countries
[25]	USA	Patients	The development and validation are not mentioned	Self-administered pre-visit questionnaire Self-administered post-visit questionnaire	Duration of illness, symptoms, etc., perceived need for AB Satisfaction, antibiotics prescribed, course of action for future
[21]	Iran	Patients	Developed by a pharmacist and a pharmacologist. Validation is not mentioned	Self-administered	Behavior (self-medication)
[35]	Kuwait	Patients and parents	Developed with the help of family practitioners. Derived from another study	Self-administered	History of disease, Attitudes, expectations, reason for consultation
[22]	Sweden	Patients and parents	Back translated and pilot tested	Self-administered postal questionnaire	Self-medication
[38]	USA	Patients and parents	The development and validation are not mentioned	Computer assisted telephone survey	Knowledge, believe, and utilization of AB
[27]	Hong Kong	Patients	Self-developed, validation not mentioned	Phone survey	Public knowledge, attitudes and behaviors regarding antibiotic

Table 2 Scales directed at doctors.

Doctor-related factors					
Study	Country	Target population	Development and validation of instrument	Implementation	Dimensions measured in scale
[46]	Turkey	Doctors	Development and validation are not mentioned	Demographics collected from patients, Questionnaires administered to doctors, Swaps taken from patients to measure appropriateness of medication	
[41]	USA	Doctors	Semi-structured questionnaire, piloted tested and modified	Mailed to a random sample	
[31]	India	Doctors	Self-developed, validation is not mentioned	Personal in-depth interview by authors	Trend in treatment of URT infections in neonates, infants and children
[50]	Canada	Doctors	Aggregated data collected data from database	NA	Inappropriate prescribing of antibiotics
[42]	Belgium	Doctors	Self-developed, Pilot tested, Included factor analysis Factor analysis was used to condense the data, using principal axis method and varimax normalized rotation	Self-administered, Sent by mail	The determinants in physicians decision making regarding the use of Antibiotics in cases of suspected respiratory infections
[40]	Belgium	Doctors	Development and validation are not mentioned	Focus group investigation	Reason behind actions, beliefs, perceptions, and attitudes
[43]	USA	Doctors	Semi-structured interviews, validation is not mentioned	Interviews administered by one of the authors	Prescribing behavior, knowledge
[32]	India	Doctors	Self-developed, validation is not mentioned	Focus groups discussions	Perceptions, attitudes and behaviors of the doctors
[51]	Canada	Doctors	Data collected from population-based prescription database	NA	Physicians' non-adherence to evidence-based antibiotic prescribing
[44]	Sweden	Doctors	Semi-structured interviews, validation is not mentioned	Qualitative interviews	How prescribing decisions were made in general How the doctors chose a specific drug therapy Information sources used

Table 2 (*Continued*)

Study	Country	Target population	Development and validation of instrument	Implementation	Dimensions measured in scale
Doctor-related factors					
[49]	USA	Doctors	Development and validation are not mentioned	Self-administered	Diagnoses, Treatments prescribed or recommended
[48]	British Columbia	Doctors	Derived from an instrument previously developed by the United States Centers for Disease Control and Prevention (CDC) Reviewed by an expert panel (content validation) Pilot tested-wording slightly modified according to feedback (face validity)	Mailed questionnaires	Attitudes and beliefs surrounding antimicrobial drug resistance and prescribing
[47]	Malaysia	Doctors	Development and validation are not mentioned	Self-administered	Information about their patients (demographics, diagnoses, . . . medications)

reviewed literature provide baseline information about factors that may affect the overuse of antibiotics in children.

In previous studies, the scales used in the studies directed at parents/patients have been self-administered in the target population [16,18,22,27—29], mailed [20,30], or administered through telephone surveys [11,15,31—34] or interviews [10,12,14].

The majority of the scales used in these studies were developed by the author(s) [30,31,34—37]. However, none of these studies attempted a full validation process of their instruments; therefore, the reliability and/or validity of these studies are questionable. Some studies attempted to validate their scales by pilot testing the scale [10,12—16,18,19,22,23,27,30], which contributed to the assessment of the face validity of the instrument. Other studies assessed content validity using focus groups [28] or expert opinions [19,21,27,29]. One study used the generalizability coefficient to assess the reliability of the scale used in the study [26]. Several scales were adopted from other studies [29,32]. However, many studies failed to mention the development and validation process associated with their instruments [11,17,20,25,26,33,38,39].

Scales designed to measure the association between physicians and antibiotic misuse in the community

Studies directed at the physician level to measure the factors associated with antibiotic overuse were reviewed in terms of their development and the validation of the instruments used (Table 2). Several studies used instruments developed by the author(s) [36,37,40,41]. A few studies assessed the face validity of the instrument by performing a pilot test [41,42]. Some studies used qualitative methods, such as interviews [36,43—45] or focus group discussions [37,40]. However, the development and validation of instruments measuring the overuse of antibiotics at the physician level were not mentioned in a number of the studies reviewed [40,46,47]. This result indicates the need to develop a valid and reliable instrument to measure the factors leading to the overuse of antibiotics associated with doctors.

In the reviewed studies, the instruments developed to measure doctors' association with antibiotic overuse were administered in several ways. Most studies used self-administered questionnaires either mailed [41,42,48] or handed to doctors [46,47,49].

Table 3 Scales directed at both populations (patients/parents and doctors).

Patient—doctor					
Study	Country	Target population	Development and validation of instrument	Implementation	Dimensions measured in scale
[63]	Turkey	Doctors and parents	Development and validation are not mentioned	Face-to-face interview with parents	Socio-demographic characteristics Perception of the physician's attitude related to rational of prescribing and informing them about the disease and the treatment
[64]	USA	Doctors and Parents	Self-developed, validation is not mentioned	Doctors: focus groups Parents: focus groups The two populations are not related	Doctors: knowledge about URTIs, prescribing behaviors and attitudes Parents: decision-making process, experiences, and attitudes about antibiotic use
[57]	UK	Doctors and patients	Development and validation are not mentioned	Self-administered	Doctors': perception of patient expectation, prescribing behavior, attitude (pressure from patient). Patients: expectations
[56]	UK	Doctors and patients	Development is not mentioned, pilot tested	Interviews	Patients': Experiences, views, behavior (self care), attitudes, knowledge expectations, and satisfaction. Doctors': knowledge, behavior and scientific evidence used
[62]	Korea	Doctors, pharmacists, patients and parents	Self-developed, pilot tested	Doctors and pharmacists: Self-administered/Mailed Patients and parents: phone calls	Knowledge and beliefs about antibiotic resistance, The effect of antibiotics on the pediatric common cold, The reasons for antibiotic prescription
[58]	Australia	Doctors and patients	Development and validation are not mentioned	Self-administered	Doctors: diagnoses, treatment. Patients were asked about their expectations. Doctors perception of patients expectations
[65]	USA	Doctors and patients	Doctors: Adapted from [NEO-PI-R] Patients: adapted from [HCCQ]	Self-administered	Patient satisfaction

Table 3 (*Continued*)

Patient—doctor					
Study	Country	Target population	Development and validation of instrument	Implementation	Dimensions measured in scale
[66]	USA	Doctors and patients	Development with the input from doctors and nurses	ARI was completed by the doctors and nurses about each patient	History, Illness, diagnosis, medication, plan
[54]	Canada	Doctors and patients/parents	Derived from a previous study (smith-flavo). Validation is not mentioned	Self-administered and interviews	Patients satisfaction
[67]	UK	Doctors and patients	Development and validation are not mentioned	Self-administered	Views, opinions and attitudes
[55]	USA	Doctors and parents	Parents questionnaire: - Expectations part was adapted from ''Kravitz 1994''. - Attitudes part was adapted from ''Virji 1991''. - Satisfaction: adapted from RAND researchers with minor changes. - The rest was self-developed. Doctors questionnaires: - Self-developed by authors A sample of medical records to check inter-rater reliability	Parents: self-administered pre-visit and post-visit questionnaires	Parental expectations, doctor—patient communication, and parental satisfaction, the relationship between parental expectation and antibiotic prescribing
[61]	USA		Adapted from Mangione-Smith 1999	Self-administered question-naires + audio-taped encounters	Parents': expectations, satisfaction Doctors: perceptions of parents expectations
[60]	USA	Doctors and parents	Self-developed, validation is not mentioned	Parents: interview Doctors: mailed questionnaires	Parents: Opinions, experiences and knowledge Doctors: perception regarding parents' views on antibiotics
[69]	UK	Doctors and patients	NA	Videoed interactions	The nature of the interaction (ethno-methodology)
[59]	USA	Doctors and parents	Adapted from Mangione-Smith 2001 Intra-rater reliability was assessed	Self-administered question-naires + audio-taped encounters	Parents expectations Doctors' perceptions of parents' expectations

Paluck [48] used an instrument previously developed by the United States Centers for Disease Control and Prevention (CDC). The instrument was piloted and reviewed by experts, and modifications were made to the instrument to match the study objectives (the development of the adapted instrument was not mentioned or cited in the study). Both the content validity and face validity were assessed in this study, but further validity and instrument reliability were not assessed.

A few studies collected aggregated data regarding diagnoses and medications prescribed using computerized databases and assessed the appropriateness of antibiotics used [50—53]. This approach could be an appropriate way to collect descriptive quantitative data related to diagnoses and treatment. However, this approach does not consider the psycho-social constructs that may be related to doctors' prescribing practices (i.e., attitudes and behaviors).

Scales to measure the association of both levels of the population (patients/parents and doctors) with antibiotic misuse in the community

Several studies were directed at both populations (doctors and parents/patients) (Table 3). These studies assessed several aspects, including patient/parent satisfaction [54—56], patient/parent expectations [56], and patient/parent expectations compared with doctors' perceptions of these expectations [57—61]. Additionally, the relationship between parental expectations and antibiotic prescribing was assessed in one study [55]. A number of studies measured the same aspects in both populations (doctors and patients/parents), including knowledge, attitudes and beliefs regarding antibiotic use [56,62].

Some studies compared patients' perceptions of physicians' attitudes in relation to the rationale for prescribing and the association of the physician's communication skills (informing patients about the disease and the treatment) with the physician's knowledge, behavior, working experience and level of education in rationales for pharmacotherapy [63,64]. A few studies assessed patients' satisfaction in relation to doctors' demographics, years of practice, and personality [54,65]. Another study assessed the appropriateness of the medication prescribed by determining symptoms and current illness from the patients' perspective and comparing this information with doctors' physical examination findings and treatment plans [66].

Scales that were directed at both target populations (patients/parents and doctors) were self-administered to patients/parents and doctors [55,57—59,61,62,65], discussed in focus groups [64] or administered through face-to-face interviews [54,56,60,63] or mailed questionnaires [60,62]. In a study conducted by Gonzales, questionnaires about each patient were completed by doctors and nurses [66].

Most of the instruments used in the reviewed literature were developed by the author(s) [55,60,62,64,66]. Some studies attempted to assess the face validity or the content validity of their instrument by either pre-testing the instrument [56,62] or using experts' opinions [66]. A few authors adapted parts of the instrument used in their study from other studies [54,55,59,61,65]. The development process and the use of a validation step were not mentioned in several of the studies reviewed [57,58,63,67].

Conclusion and recommendations

Several scales have been developed to measure the factors associated with antibiotic misuse worldwide. This systematic review examines the development and implementation of these scales independently. None of the published scales designed to measure the factors associated with antibiotic misuse were fully validated. Some scales assessed content validity, whereas others assessed face validity. However, further validation steps, such as construct validity and criterion-related validity, must be performed to obtain a fully validated instrument. None of the published scales conducted a full workup process for the instrument used. It is therefore important to develop a fully validated scale that measures the factors underlying antibiotic misuse. A fully validated instrument could help to identify the factors underlying antibiotic overuse and facilitate the generation of effective intervention protocols to assist in the reduction of antibiotic overuse in communities.

From the literature, it is clear that no adequately validated instruments exist that measure the factors associated with antibiotic overuse in either doctor or patient/parent populations. This result emphasizes the need for a valid and reliable measurement scale that can be used to measure constructs underlying antibiotic overuse and/or over-prescribing.

The reviewed scales could be used as a basis for developing a new scale. The newly developed

scale should undergo further validation steps, such as content validity, face validity, construct validity, and criterion-related validity. Following these developmental and validation steps, the factors influencing the overuse of antibiotics in children with upper respiratory tract infections can be measured using a valid and reliable instrument.

References

[1] DeVon H, Block M, Moyle-Wright P, Ernst D, Hayden S, Lazzara D, et al. A psychometric toolbox for testing validity and reliability. Journal of Nursing Scholarship 2007;39(2):155—64.

[2] Ramaker C, Marinus J, Stiggelbout A, Van Hilten B. Systematic evaluation of rating scales for impairment and disability in Parkinson's disease. Movement Disorders 2002;17(5):867—76.

[3] Lawshe C. A quantitative approach to content validity. Personnel Psychology 1975;28(4):563—75.

[4] Lynn M. Determination and quantification of content validity. Nurse Research 1986;35(6):382—5.

[5] Dalkey N, Helmer O. An experimental application of the Delphi method to the use of experts. Management Science 1963;9(3):458.

[6] Dalkey N. The Delphi method: an experimental study of group opinion. Santa Monica: RAND Corporation; 1969.

[7] Hsu C, Sandford B. The Delphi technique: making sense of consensus. Practical Assessment, Research & Evaluation 2007;12(10):1—8.

[8] Yousuf M. Using experts' opinions through Delphi technique. Practical Assessment, Research & Evaluation 2007;12(4):1—8.

[9] DeCoster, J. Overview of Factor Analysis; 1998, 29 April 2011; Available from: http://www.stat-help.com/notes.html.

[10] Chan G, Tang S. Parental knowledge, attitudes and antibiotic use for acute upper respiratory tract infection in children attending a primary healthcare clinic in Malaysia. Singapore Medical Journal 2006;47(4):266—70.

[11] Belongia E, Naimi T, Gale C, Besser R. Antibiotic use and upper respiratory infections: a survey of knowledge, attitudes, and experience in Wisconsin and Minnesota. Preventive Medicine 2002;34(3):346—52.

[12] Borg M, Scicluna E. Over-the-counter acquisition of antibiotics in the Maltese general population. International Journal of Antimicrobial Agents 2002;20(4):253—7.

[13] Gonzales R, Wilson A, Crane L, Barrett P. What's in a name? Public knowledge, attitudes, and experiences with antibiotic use for acute bronchitis. The American Journal of Medicine 2000;108(1):83—5.

[14] Mitsi G, Jelastopulu E, Basiaris H, Skoutelis A, Gogos C. Patterns of antibiotic use among adults and parents in the community: a questionnaire-based survey in a Greek urban population. International Journal of Antimicrobial Agents 2005;25(5):439—43.

[15] Parimi N, Pereira L, Prabhakar P. Caregivers' practices, knowledge and beliefs of antibiotics in paediatric upper respiratorytract infections in Trinidad and Tobago: a cross-sectional study. BMC Family Practice 2004;5:28.

[16] Awad A, Eltayeb I, Matowe L, Thalib L. Self-medication with antibiotics and antimalarials in the community of Khartoum State, Sudan. Journal of Pharmacy and Pharmaceutical Sciences 2005;8(2):326—31.

[17] Kogan M, Pappas G, Yu S, Kotelchuck M. Over-the-counter medication use among us preschool-age children. Journal of the American Medical Association 1994;272(13):1025—30.

[18] Bawazir S. Prescribing pattern at community pharmacies in Saudi Arabia. International Pharmacy Journal 1992;6(5).

[19] Bi P, Tong S, Partonc K. Family self-medication and antibiotics abuse for children and juveniles in a Chinese city. Social Science & Medicine 2000;50(10):1445—50.

[20] Grigoryan L, Burgerhof J, Haaijer-Ruskamp F, Degener J, Deschepper R, Monnet D, et al. Is self-medication with antibiotics in Europe driven by prescribed use? Journal of Antimicrobial Chemotherapy 2007;59(1):152—6.

[21] Sarahroodi S, Arzi A, Sawalha A, Ashtarinezhad A. Antibiotics self-medication among southern iranian university students. International Journal of Pharmacology 2010;6:48—52.

[22] Svensson E, Haaijer-ruskamp F, Lundborg C. Self-medication with antibiotics in a Swedish general population. Scandinavian Journal of Infectious Diseases 2004;36(6—7):450—2.

[23] Al-Azzam S, Al-Husein B, Alzoubi F, Masadeh M, Al-Horani M. Self-medication with antibiotics in Jordanian population. International Journal of Occupational Medicine Environmental Health 2007;20(4):373—80.

[24] Linstone, H. Turoff M. The Delphi method techniques and applications; 2002.

[25] Ray D, Rohren C. Characteristics of patients with upper respiratory tract infection presenting to a walk-in clinic. Mayo Clinic Proceedings 2001;76(2):169—73.

[26] Crossley J, Eiser C, Davies H. Children and their parents assessing the doctor—patient interaction: a rating system for doctors' communication skills. Medical Education 2005;39(8):820—8.

[27] Chan C. What do patients expect from consultations for upper respiratory tract infections? Family Practice 1996;13(3):229—35.

[28] Larson E, Dilone J, Garcia M, Smolowitz J. Factors which influence latino community members to self-prescribe antibiotics. Nursing Research 2006;55(2):94—102.

[29] Sorkhou I, Al-Qallaf B, Hajiah A, Al-Sheibani H, Bayoomi A, Mustafa A. Perceptions of patients attending primary care in Kuwait regarding upper respiratory tract infections. Kuwait Medical Journal 2002;34(4):272—5.

[30] Kuzujanakis M, Kleinman K, Rifas-Shiman S, Finkelstein J. Correlates of parental antibiotic knowledge, demand, and reported use. Ambulatory Pediatrics 2003;3(4):203—10.

[31] Braun B, Fowles J. Characteristics and experiences of parents and adults who want antibiotics for cold symptoms. Archives of Family Medicine 2000;9(7):589—95.

[32] Corbett K, Gonzales R, Leeman-Castillo B, Flores E, Maselli J, Kafadar K. Appropriate antibiotic use: variation in knowledge and awareness by Hispanic ethnicity and language. Preventive Medicine 2005;40(2):162—9.

[33] Wilson A, Crane L, Barrett P, Gonzales R. Public beliefs and use of antibiotics for acute respiratory illness. Journal of General Internal Medicine 1999;14(11):658—62.

[34] You J, Yau B, Choi K, Chau C, Huang Q, Lee S. Public knowledge, attitudes and behavior on antibiotic use: a telephone survey in Hong Kong. Infection 2008;36(2):153—7.

[35] Trepka M, Belongia E, Chyou P, Davis J, Schwartz B. The effect of a community intervention trial on parental knowledge and awareness of antibiotic resistance and appropriate antibiotic use in children. Pediatrics 2001;107(1):e6.

[36] Bhasin S, Budden E, Ketkar A, Pawar A. Current trends in the treatment of upper respiratory tract infections in neonates, infants and children: a survey. Indian Journal of Pharmacology 2002;34:62—3.

[37] Kotwani A, Wattal C, Katewa S, Joshi P, Holloway K. Antibiotic use in the community: what factors influence primary care physicians to prescribe antibiotics in Delhi, India? Family Practice 2010;27:684—90.
[38] Peche're J. Patients' interviews and misuse of antibiotics. Clinical Infectious Diseases 2001;33(S3):S170—3.
[39] Curry M, Sung L, Arroll B, Goodyear-Smith F, Kerse N, Norris P. Public views and use of antibiotics for the common cold before and after an education campaign in New Zealand. The New Zealand Medical Journal 2006;119(1233):1—8.
[40] Coenen S, Van Royen P, Vermeire E, Hermann I, Denekens J. Antibiotics for coughing in general practice: a qualitative decision analysis. Family Practice 2000;17(5):380—5.
[41] Bauchner H, Pelton S, Klein J. Parents, physicians, and antibiotic use. Pediatrics 1999;103(2):395.
[42] Coenen S, Michiels B, Van Royen P, Van der Auwera J, Denekens J. Antibiotics for coughing in general practice: a questionnaire study to quantify and condense the reasons for prescribing. BMC Family Practice 2002;3(1):16.
[43] Hart A, Pepper G, Gonzales R. Balancing acts: deciding for or against antibiotics in acute respiratory infections. The Journal of Family Practice 2006;55(4).
[44] Ljungberg C, Lindblad A, Tully M. Hospital doctors' views of factors influencing their prescribing. Journal of Evaluation in Clinical Practice 2007;13(5):765—71.
[45] Crowe S, Tully M, Cantrill J. The prescribing of specialist medicines: what factors influence GPs' decision making? Family Practice 2009;26(4):301—8.
[46] Ayranci U, Akgün Y, Unluoglu I, Kiremitci A. antibiotic prescribing patterns for sore throat infections. Annals of Saudi Medicine 2005;25(1):22—8.
[47] Teng C, Leong K, Aljunid S, Cheah M. Antibiotic prescription in upper respiratory tract infections. Asia Pacific Family Medicine 2004;3(1—2):38—45.
[48] Paluck E, Katzenstein D, Frankish J, Herbert C, Milner R, Speert D, et al. Prescribing practices and attitudes toward giving children antibiotics. Canadian Family Physician 2001;47:521—7.
[49] Mangione-Smith R, Elliott M, McDonald L, McGlynn E. An observational study of antibiotic prescribing behavior and the Hawthorne effect. Health Services Research 2002;37(6):1603—23.
[50] Cadieux G, Tamblyn R, Dauphinee D, Libman M. Predictors of inappropriate antibiotic prescribing among primary care physicians. Canadian Medical Association Journal 2007;177(8):877—83.
[51] Kozyrskyj A, Dahl M, Chateau D, Mazowita G, Klassen T, Law B. Evidence-based prescribing of antibiotics for children: role of socioeconomic status and physician characteristics. Canadian Medical Association Journal 2004;171(2): 139—45.
[52] Grijalva C, Nuorti J, Griffin M. Antibiotic prescription rates for acute respiratory tract infections in US ambulatory settings. Journal of the American Medical Association 2009;302(7):758—66.
[53] Davey P, Ferech M, Ansari F, Muller A, Goossens H. Outpatient antibiotic use in the four administrations of the UK: cross-sectional and longitudinal analysis. Journal of Antimicrobial Chemotherapy 2008.
[54] Lehmann F, Fontaine D, Bourque A, Côté L. Measurement of patient satisfaction: the smith-falvo patient—doctor interaction scale. Canadian Family Physician 1988;34: 2641—5.
[55] Mangione-Smith R, McGlynn E, Elliott M, Krogstad P, Brook R. The relationship between perceived parental expectations and pediatrician antimicrobial prescribing behavior. Pediatrics 1999;103(4):711—8.
[56] Butler C, Rollnick S, Pill R, Maggs-Rapport F, Stott N. Understanding the culture of prescribing: qualitative study of general practitioners' and patients' perceptions of antibiotics for sore throats. British Medical Journal 1998;317(7159):637—42.
[57] Britten N, Ukoumunne O. The influence of patients' hopes of receiving a prescription on doctors' perceptions and the decision to prescribe: a questionnaire survey. British Medical Journal 1997;315(7121):1506—10.
[58] Cockburn J, Pit S. Prescribing behaviour in clinical practice: patients' expectations and doctors' perceptions of patients' expectationsóa questionnaire study. British Medical Journal 1997;315(7107):520—3.
[59] Stivers T, Mangione-Smith R, Elliott M, McDonald L, Heritage J. Why do physicians think parents expect antibiotics? What parents report vs what physicians believe. The Journal of Family Practice 2003;52(2):140—8.
[60] Palmer D, Bauchner H. Parents' and physicians' views on antibiotics. Pediatrics 1997;99(6).
[61] Mangione-Smith R, McGlynn E, Elliott M, McDonald L, Franz C, Kravitz R. Parent expectations for antibiotics, physician—parent communication, and satisfaction. Archives of Pediatrics and Adolescent Medicine 2001;155(7):800—6.
[62] Cho H, Hongb S, Parkc S. Knowledge and beliefs of primary care physicians, pharmacists, and parents on antibiotic use for the pediatric common cold. Social Science & Medicine 2004;58:623—9.
[63] Akici A, Kalaca S, Ugurlu U, Oktay S. Prescribing habits of general practitioners in the treatment of childhood respiratory-tract infections. European Journal of Clinical Pharmacology 2004;60:211—6.
[64] Barden L, Dowell S, Schwartz B, Lackey C. Current attitudes regarding use of antimicrobial agents: results from physicians' and parents' focus group discussions. Clinical Pediatrics 1998;37(11):665—71.
[65] Duberstein P, Meldrum S, Fiscella K, Shields C, Epstein R. Influences on patients' ratings of physicians: physicians demographics and personality. Patient Education and Counseling 2007;65(2):270—4.
[66] Gonzales R, Barrett P, Crane L, Steiner J. Factors associated with antibiotic use for acute bronchitis. Journal of General Internal Medicine 1998;13(8):541—8.
[67] Macfarlane J, Holmes W, Macfarlane R, Britten N. Influence of patients' expectations on antibiotic management of acute lower respiratory tract illness in general practice: questionnaire study. British Medical Journal 1997;315(7117):1211—4.
[68] Goff S, Mazor K, Meterko V, Dodd K, Sabin J. Patients' beliefs and preferences regarding doctors' medication recommendations. JGIM 2008;23(3):236—41.
[69] Rapley T, May C, Heaven B, Murtagh M, Graham R, Kaner E, et al. Doctor-patient interaction in a randomised controlled trial of decision-support tools. Social Science & Medicine 2006;62(9):2267—78.